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(71)(72) Applicant and Inventor: SUGDEN, Kurt, David [GB/GB]; 5 Beckside Court, Brampton, Carlisle, Cumbria CA8 1NF (GB).

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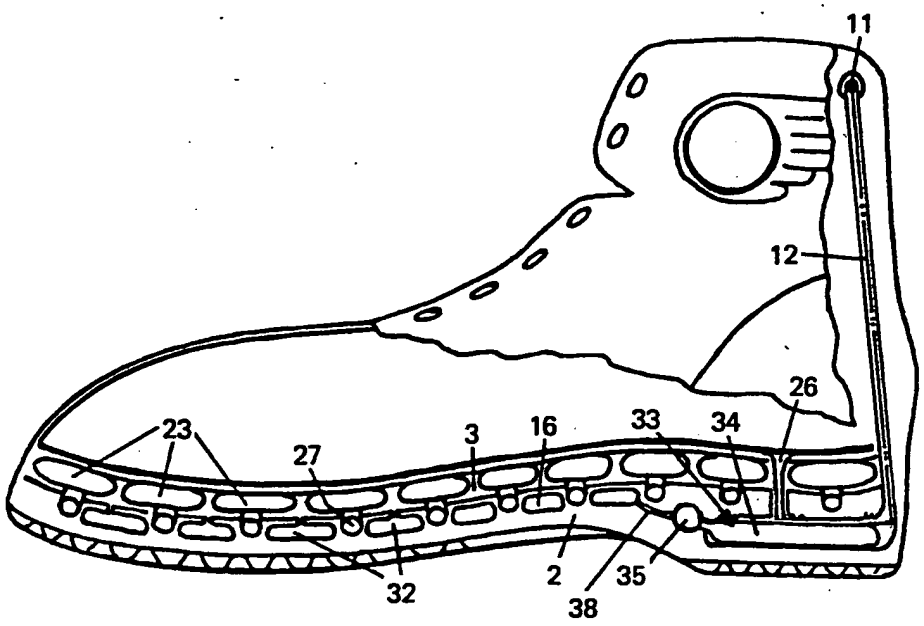
(54) Title: AERATED FOOTWEAR



(57) Abstract

Footwear, eg. military/work, sport/trainer type boots (figure 1), or every day shoe styles for male or female, young or old. That incorporates mechanisms that utilise the dynamic foot pressure with articulation of the foot and or ankle to draw in new air, that may be filtered, deodorised and or medicated, which is then dispersed about the foot keeping it cool and aerated. Provision is also made to include simultaneous extraction of moisture or liquids and venting these overboard. The intake air may also be additionally cooled or heated by chemical or electrical means.

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Aerated footwear

This invention relates to improvements in and relating to footwear.

Footwear, for example, military work, sport/trainer type boots or every day shoe styles for both sexes, young or old as well known as a means for providing both foot protection and assisting the bodies motive energy with traction.

Enclosing the foot however, does not allow the heat created by the transference of energy of the bodies components of weight and speed to be dissipated. This constrained heat causes the body to both increase the blood flow to the feet and produce perspiration, both of which enlarge the foot. Feet constrained in a hot and humid environment, become prone to blisters, odour and other associated medical disorders, for example athletes foot. To alleviate those problems the feet must be kept both cool and aerated.

Accordingly the present invention provides an item of footwear incorporating a self acting aerating mechanism.

The self acting mechanism can comprise at least one cavity having an inlet to receive ambient air and at least one outlet to discharge air into the item of footwear.

The inlet and outlet can each be provided with one way valves.

The mechanism can comprise a plurality of cavities formed in a first sole portion.

The mechanism can also include a second sole portion in which the second sole portion includes one or more one way valves in the or each outlet from the or each cavity in the first sole portion.

The mechanism can also include a main air inlet in a wall of the item of footwear, the main air inlet being connected to a manifold and the cavities in the first sole portion being connected to the manifold.

The main inlet can be provided with a filter.

The item of footwear can also include a bellows mechanism which can be operated by either flexure and or dynamic pressure applied to the item of footwear.

The bellows mechanism can be secured within the item of footwear by attachment means.

The attachment means can comprise a rod and or a strut so that the bellows can be compressed and expanded as the item of footwear is flexed due to articulation and or dynamic pressure of the foot of the wearer of the item of footwear.

The mechanism can also include at least one cavity arranged to collect liquid internally of the item of footwear, which can be scavenged through a one way valve system and arranged to discharge the liquid from the footwear through a one way valve system to a liquid outlet which can incorporate a dispersion filter.

A specific embodiment of the invention will now be described by way of example with reference to the accompanying drawings in which;

Figure 1 shows in perspective, a boot with the location of the mechanism;

Figure 2 illustrates the sectional view of the mechanism;

Figure 3 shows a plan view of the sole mechanism;

Figure 4 illustrates a cavity as a single module;

Figure 5 illustrates a pneumatic diagram;

Figure 6 illustrates the liquid collection mechanism; and

Figure 7 illustrates the air inlet and distribution ducts.

Referring to the drawing the boot comprises the upper parts (1) with air intake duct (5) connected to filter housing (7) which holds disposable filter (6). The exit duct (8) is connected to filter housing (10) which holds dispersion filter (9). The heel cavity (4) houses bellows mechanism (34) which may be activated by heel tendons (12) secured at anchor points (11) and or by one or more longitudinal tendons (13) secured at the front of the sole thereof (14) and or by one or more compression struts (26). The upper sole (3) comprised of modules (19) attached to lower sole (2) and may be attached to a pressure distribution over-sole (28), which incorporates air distribution vents (18), which may also be covered by a porous over sole (25).

With the foot raised to its neutral position, the chambers (23) and (34) are expanded to their normal maximum volume, due to the moulding materials elasticity, for example silicone rubber. Tendons (12), (13) and (26) a unstressed.

As the foot is moved forward, articulation of the ankle causes pressure to be applied via heel tendon to section of heel bellows through pressure distribution diaphragm (33), the expended liquid

passes through a one way valve (35), then ducted via duct (24), for dispersion overboard.

When foot pressure is applied, air cavities (23) in modules (19) are compressed, their cavity size, shape and strength control pressure distribution. The air is forced out through hole (20), one way valve (15) through air manifold (21), via vents (18) to be dispersed through porous over sole (25).

If liquid venting is required, bellows (34) will be compressed via strut (26), forcing any liquid out through one way valve into ducting (24) outlet (8) and hence to dispersion filter (9).

As the foot is rotated forward, longitudinal tendons (13) are torsioned by the curvature of the foot, operating the second heel bellows mechanism which functions as previously described.

As the body moves forward in the stride, the ankle rotates forward, tensioning both longitudinal tendons and or the other heel tendon, activating heel bellows mechanism, the liquid again being discharged overboard via valve and ducting.

When foot pressure is removed, air cavities return to their maximum volume, drawing new air through filter (6), via ducting (31), through one way valve (30) and hole (20). When liquid bellows return to normal, they suck in any liquid that has

collected through slots (37), via duct (38) and interconnecting ducts (36). Unused cavities (16), being for weight reduction.

The mechanism is now ready to repeat the process of aerating in whole or part movement of the foot.

The example shown in the drawing uses a single one way in and one way out valve per module, which provides for fail safe operation, as if one valve fails, the mechanism will still function via the remaining modules. However, the number of valves used per cavity and or cavity sole assembly may be changed.

The valves may be either an intrinsic part of the cavity and or cavities and or lower sole thereof, and or constructed as separate component assembly to be attached forming part of the assembly.

The aerating sole may be constructed in one or more pieces and or modules. Separate modules have the advantages for pre-testing, the valves being assembled as a pair located in a housing ready for bonding into the lower sole and to the module in/outlet.

The intake air filter housing (7) may be constructed to accommodate at least one reusable and or replacement filter which also can have the provision for deodorising and or medicating the

air intake for subsequent dispersion about the footwear.

It will be appreciated that the air must be forced into the footwear, not extracted, as this has the tendency to constrict the footwear onto the foot, thus reducing the required air pockets and hence blisters etc.

The design must encompass as much of the foot area as possible in order to utilise a maximum of foot pressure area, which is then more efficient to convert to air volume for distribution. This is accomplished by using a number of modules/cavities (1, 2 or even three are very inefficient, due centre of pressure movement) which are each designed in size, shape and resilience to compression via wall thickness and or material, to compensate and control differences in location foot pressures/stresses. Maximum foot pressure areas eg. ball and heel, are further equalised by incorporating a pressure distribution oversole.

By using a plurality of cavities, each with its own way positive (snap) inlet and outlet valves, ensures a failsafe construction, as failure of one valve, still allows the rest to operate ie. with eleven valves as used on the prototype, one failure means it would still operate at say 90%.

The valves operate so that they are open or closed under slight pressure, highly resilient to reverse pressure and don't squeak.

Also one in and out valve can be combined into a valve assembly housing,this uses far less volume, is easy for assembly into the mouldings, cost less, protects the valves and is really all that is required.

By inserting a valve assembly around, it operates in reverse, thus a cavity may be utilised for water extraction.

Water extraction has not been so far utilised, so this may be carried out by the heel bellows mechanism, leaving the whole of the foot area to continue aerating/drying out the boot.

Articulation of the foot, and foot rotation have also not been so far utilised, so they are options left to be used as required.

The heel bellows uses one or more compression struts that are actuated by the pressure distribution oversole, and are sealed to stop water getting into the heel. They act upon the heel bellows pressure distribution plate, this is bonded to a flap extrusion of the heel moulding, thus acting as a hinge. The bellows being inserted from the bottom, connected/glued to the moulded-in-valve housing and the heel bonded on.

The cavities have been designed to allow them to be compressed so that the <u>total</u> volume is utilised, ie. they can be flattened this is not so, in fact far from it, in any known designs, as it

is obviously important that the compression distance is reduced to a minimum, otherwise the sole will be far too thick. The lower sole thickness is used to incorporate the mechanism (ducts/valves etc.) so that there is hardly any increase in total height required.

The inlet and distribution ducting is designed for maximum ease of air flow with volumetric efficiency as far as possible, and location/directions as a compromise against valve location, areas of ventilation etc. The air manifolds are shown going to the edges of the boot, because it is easiest and as the foot comes under pressure it expands outwards and so does the shoe under the flexing action. This is beneficial as it leaves the gap at the sides, which has been utilised. The vents may be led to say under the toe areas etc.

The valve housing is located laterally, since, if they are longitudinal, it could restrict the shoe being and damage the valves. They are enclosed in a alloy housing, light yet strong.

For other types of footwear, the design functions may be utilised in whole or part or other combinations thereof, to suit ergonomic and aesthetic style requirements. For example

1. Ladies high heel shoe may utilise only the cavity sole, drawing air in through an inconspicuous heel vent.

2. Ordinary style enclosed shoe that is below ankle height may utilise the aerating sole with heel bellows mechanism for liquid extraction, venting could be installed under the arch.

3. Liquid extraction may be increased by utilising more than one collection cavity and or location.

4. Mechanism functions may be changed, the heel bellows may be operated by dynamic pressure and or by articulation methods.

For additional cooling or heating of the intake air, packs may be attached to the boot which couple to the air intakes.

Claims

1. An item of footwear incorporating a self acting aerating mechanism.

2. An item of footwear as claimed in claim 1 in which the self acting aerating mechanism comprises at least one cavity having an inlet to receive ambient air and at least one outlet to discharge air into the item of footwear.

3. An item of footwear as claimed in any one of the preceding claims in which the inlet and outlet are providing with one way valves.

4. An item as claimed in claim 3 in which the mechanism comprises a plurality of cavities formed in a first sole portion.

5. An item as claimed in claim 4 in which the mechanism can include one or more one way valves in the or each outlet from the or each cavity.

6. An item of footwear as claimed in claim 5 in which the mechanism can include a second sole portion, the second sole portion may include one or more one way valves in the

or each outlet from the or to each cavity.

7. An item of footwear as claimed in claim 5 or claim 6 having a main air inlet in a wall of the item of footwear, the main air inlet being connected to a manifold, and the cavities each being connected to the manifold.

8. An item of footwear as claimed in claim 7 in which the main air inlet includes the provision for a filter.

9. An item of footwear as claimed in any of the preceding claims 4 to 8 including at least one cavity arranged to receive liquid internally of the item of footwear, which can scavenge the liquid through a one way valve system, then to discharge the liquid overboard through a one way valve system to a liquid outlet that can incorporate a dispersion filter.

10. An item of footwear as claimed in any one of the preceding claims comprising a bellows mechanism secured to the item of footwear by attachment means, the bellows mechanism being operable by dynamic foot pressure and or by flexure of the item of footwear.

11. An item of footwear constructed and arranged for use and operation substantially as herein described and with reference to the accompanying drawings.

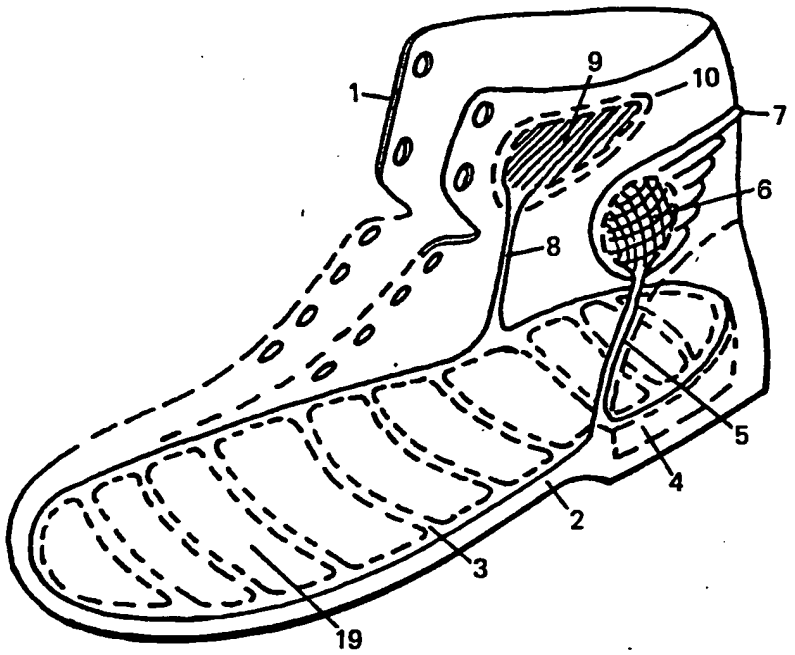

FIG. 1

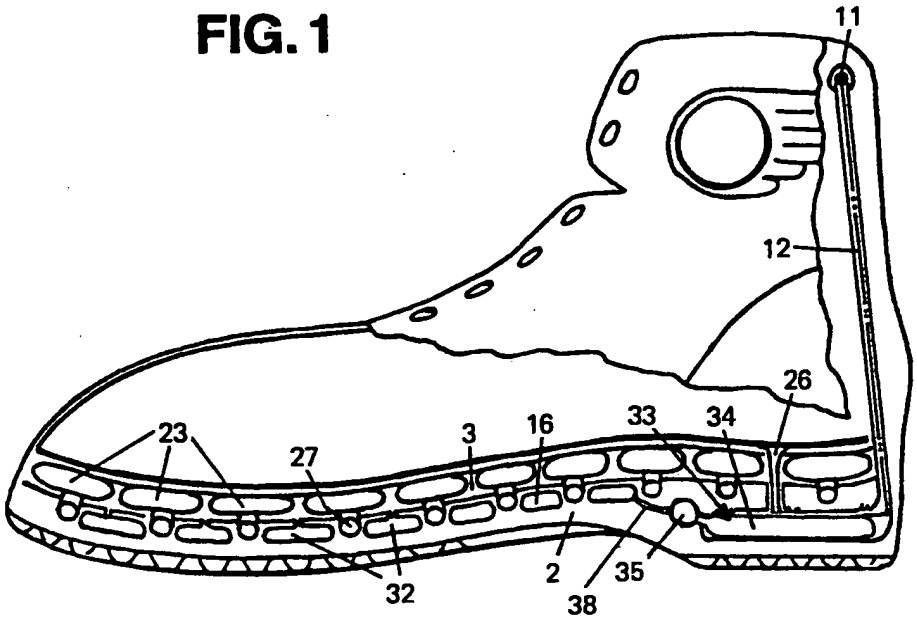

FIG. 2

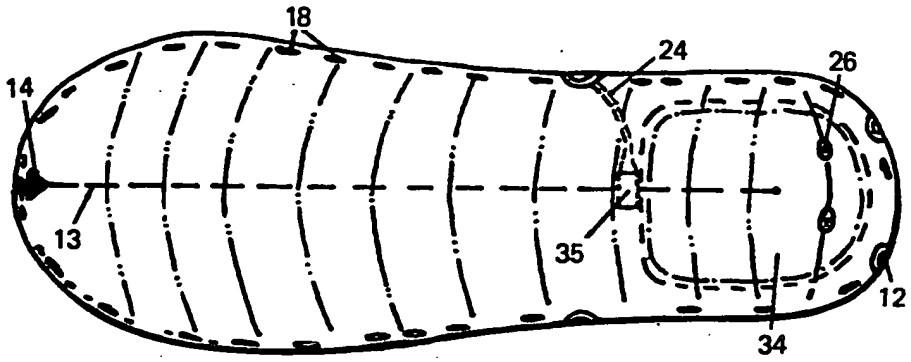

FIG. 3

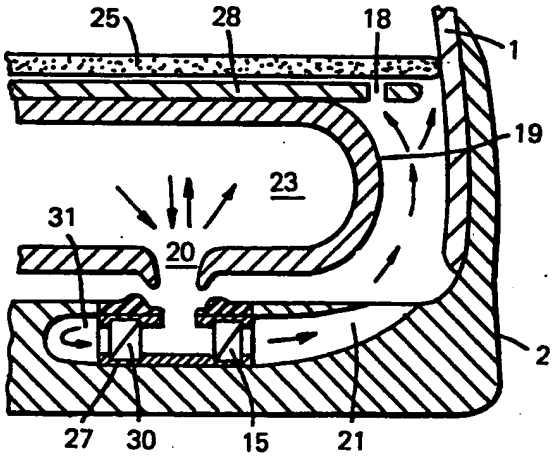

FIG. 4

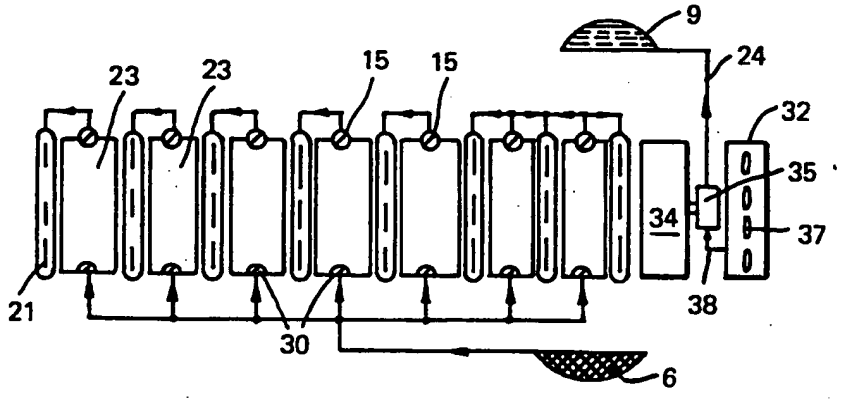

FIG. 5

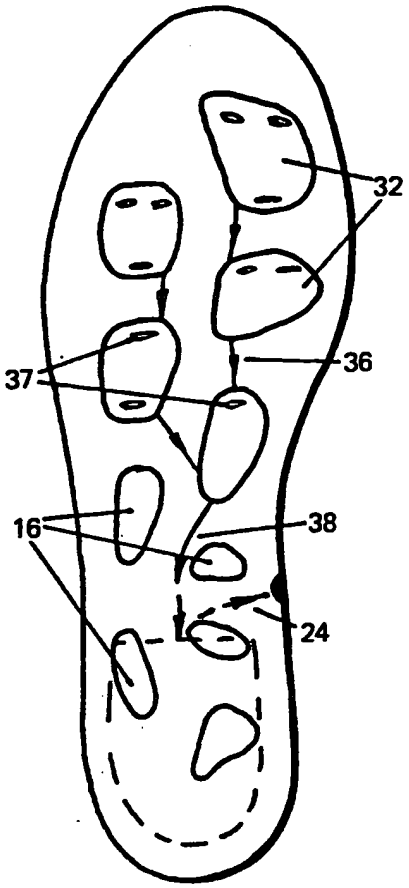

FIG. 6

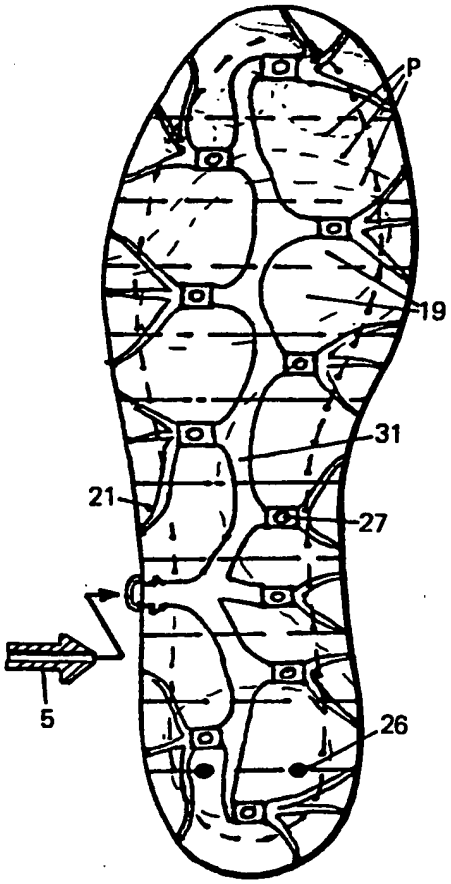

FIG. 7

INTERNATIONAL SEARCH REPORT

Intern. al Application No
PCT/GB 93/02173

A. CLASSIFICATION OF SUBJECT MATTER
IPC 5 A43B7/06 A43B7/08

According to International Patent Classification (IPC) or to both national classification and IPC

B. FIELDS SEARCHED

Minimum documentation searched (classification system followed by classification symbols)
IPC 5 A43B

Documentation searched other than minimum documentation to the extent that such documents are included in the fields searched

Electronic data base consulted during the international search (name of data base and, where practical, search terms used)

C. DOCUMENTS CONSIDERED TO BE RELEVANT

Category *	Citation of document, with indication, where appropriate, of the relevant passages	Relevant to claim No.
X	WO,A,86 02240 (K. CALDWELL) 24 April 1986 see the whole document	1-6
X	DE,A,34 21 656 (J. KUHN) 12 December 1985 see the whole document	1-6
X	FR,A,2 558 044 (H. CHU) 19 July 1985 see the whole document	1-3
A	US,A,3 754 339 (S. TERASAKI) 28 August 339 see the whole document	10
A	US,A,2 354 407 (W. SHAKS) 25 July 1944 see the whole document	10

☐ Further documents are listed in the continuation of box C.

☒ Patent family members are listed in annex.

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Date of the actual completion of the international search	Date of mailing of the international search report
8 February 1994	28.02.94

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INTERNATIONAL SEARCH REPORT

Information on patent family members

Intern al Application No
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Patent document cited in search report	Publication date	Patent family member(s)		Publication date
WO-A-8602240	24-04-86	AU-A-	4869885	02-05-86
		EP-A-	0233181	26-08-87
		GB-A,B	2165439	16-04-86
DE-A-3421656	12-12-85	NONE		
FR-A-2558044	19-07-85	NONE		
US-A-3754339	28-08-73	NONE		
US-A-2354407		NONE		